REMARKS

On April 5, 2002, Applicant has filed an Amendment and Response to the Office Action dated November 26, 2001. The Applicant respectfully requests the Examiner to enter the above supplemental amendments to the claims of the patent application and reconsider the patent application in view of the following remarks.

In this Supplemental Amendment and Response, no claims have been canceled, no claims have been added and one claim has been amended. Accordingly, Claim 1-10 are pending.

II. Claim 1 Rejected Under 35 U.S.C. § 102(b)

Claim 1 was rejected under 35 U.S.C. § 102(b) as being anticipated by Steckl et al. ("Review of Focused ion beam mixing for the fabrication of GaAs based optoelectronic devices", J. Vac. Sci. Technol. B, Vol 13(6) pp 2570-2575 (11/12-1995)). Applicant respectfully traverses this rejection.

It is axiomatic that to anticipate a claim, every element of the claim must be disclosed within a single reference. Thus, if even one feature of Claim 1 is not found in Steckl, the rejection of Claim 1 under 35 U.S.C. § 102 as being anticipated by Steckl must be overturned.

Claim 1 recites a process in which a multi-layer material composed of thin layers is irradiated by means of a beam of light ions having an energy of the order of or less than a hundred KeV, wherein the irradiation dose is controlled so as to be a few 10^{16} ions/cm^2 or less. By using a beam of light ions having an energy of the order of less than a hundred KeV and controlling the irradiation does to be a few 10^{16} ions/cm^2 or less, the claimed process is able to modify the composition of 2 or 3 nearest atomic planes in the multi-layer material around an interface between two layers of the latter without overall mixing of the different layers of the multi-layer material.

Applicant notes that the present invention enables the control of the successive individual atomic displacements at the interface between different layers, without overall mixing, but with a controlled modification of composite in the two atomic layers above and below each initial interface.

Accordingly, Claim 1 has been amended to require that the irradiation modifies the composition of 2 or 3 nearest atomic planes in the multi-layer material around an interface between two layers of the latter without overall mixing of the different layers of the multi-layer material.

In contrast, Steckl teaches using a beam of heavy ions (Si^{++} ions). Due to the use of these heavy ions, a mixed region is formed on the irradiated structure in Steckl. Therefore, in Steckl, the multilayer structure disappear, with irradiation, and forms a general mixed region. In fact, the Examiner admits in the Office Action that Steckl uses a beam of Si^{++} ions, which are heavy ions, to form a mixed region as shown in figure 1 (page 3).

In light of the foregoing, Applicant respectfully submits that Claim 1 is not anticipated by Steckl and requests that the rejection of Claim 1 under 35 U.S.C. § 102(b) be withdrawn.

III. Claims 1 and 3-5 Rejected Under 35 U.S.C. § 102(b)

Claims 1 and 3-5 were rejected under 35 U.S.C. § 102(b) as being anticipated by Jung et al. ("Atomic Transport by Ion Beam Mixing in the Radiation Enhanced Diffusion Region", Mat. Res. Soc. Symp. Proc. Vol. 354 pp. 21-26 (1995)). Applicant respectfully traverses this rejection.

Applicant respectfully submits that Jung fails to teach or suggest a process in which a multi-layer material composed of thin layers is (1) irradiated by means of a beam of light ions having an energy of the order of or less than a hundred KeV and (2) the irradation dose is controlled so as to be a few 10^{16} ions/cm^2 or less, wherein the irradiation modifies the composition of 2 or 3 nearest atomic planes in the multi-layer

material around an interface between two layers of the latter without overall mixing of the different layers of the multi-layer material.

In contrast, Jung teaches using a beam of heavy ions (Ar^+ ions) that modify the chemical composition of different layers of the multi-layer material when it is irradiated. As a result, the irradiation process taught by Jung causes formation of a mixed region and does not permit maintaining the multilayer structure.

Accordingly, Applicant respectfully submits that Claims 1 and 3-5 are not anticipated by Jung and requests that the rejection of Claims 1 and 3-5 under 35 U.S.C. § 102(b) be withdrawn.

IV. Claims 1 and 3-5 Rejected Under 35 U.S.C. § 102(b)

Claims 1 and 3-5 were rejected under 35 U.S.C. § 102(b) as being anticipated by Kanayama et al. ("Fine Pattern Definition with Atomic Intermixing Induced by Focused Ion Beam and Its Application to X-ray Mask Fabrication", J. Vac Sci. Technol. B, Vol 9(2) pp. 296-301 (4/1991)). Applicant respectfully traverses this rejection.

Applicant respectfully submits that Kanayama fails to teach or suggest a process in which a multi-layer material composed of thin layers is (1) irradiated by means of a beam of light ions having an energy of the order of or less than a hundred KeV and (2) the irradation dose is controlled so as to be a few 10^{16} ions/cm^2 or less, wherein the irradiation modifies the composition of 2 or 3 nearest atomic planes in the multi-layer material around an interface between two layers of the latter without overall mixing of the different layers of the multi-layer material.

In contrast, Kanayama teaches using a beam of heavy ions (Kr^+ ions) that modify the chemical composition of different layers of the multi-layer material when it is irradiated. As a result, the irradiation process taught by Kanayama causes formation of a mixed region and does not permit maintaining the multilayer structure.

Accordingly, Applicant respectfully submits that Claims 1 and 3-5 are not anticipated by Kanayama and requests that the rejection of Claims 1 and 3-5 under 35 U.S.C. § 102(b) be withdrawn.

V. **Claims 1 and 3-5 Rejected Under 35 U.S.C. § 102(b)**

Claims 1 and 3-5 were rejected under 35 U.S.C. § 102(b) as being anticipated by Amaral et al. ("Very Thin Fe/Ni modulation multilayer Films Under Ion Bombardment", J. Appl. Phys., Vol. 81(8) pp. 4773-4775 (04/1997)). Applicant respectfully traverses this rejection.

Applicant respectfully submits that Amaral fails to teach or suggest a process in which a multi-layer material composed of thin layers is (1) irradiated by means of a beam of light ions having an energy of the order of or less than a hundred KeV and (2) the irradiation dose is controlled so as to be a few 10^{16} ions/cm^2 or less, wherein the irradiation modifies the composition of 2 or 3 nearest atomic planes in the multi-layer material around an interface between two layers of the latter without overall mixing of the different layers of the multi-layer material.

In contrast, Amaral teaches using a beam of heavy ions that destroy and modify the chemical composition of different layers of the multi-layer material when it is irradiated. As a result, the irradiation process taught by Amaral causes formation of a mixed region and does not permit maintaining the multilayer structure.

Additionally, Applicant notes that the dosages indicated in Amaral are presented as causing mixing. The doses used in Amaral are of 10^{17} ions/cm^2, which is greater than the irradiation dose set forth in Claim 1.

Furthermore, Amaral teaches away from the use of the light ions such as He^+ ions because in the Amaral reference, He^+ ions are presented as being "less effective". In this regard, Amaral discloses that mixing with Ne is "more effective than with He^+ ions of similar dose."

In light of the foregoing, Applicant respectfully submits that Claims 1 and 3-5 are not anticipated by Amaral and requests that the rejection of Claims 1 and 3-5 under 35 U.S.C. § 102(b) be withdrawn.

VI. Claims 1 and 2 Rejected Under 35 U.S.C. § 103(a)

Claims 1 and 2 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Steckl. Applicant respectfully traverses this rejection.

Applicant respectfully submits that Steckl fails to teach or suggest a process in which a multi-layer material composed of thin layers is (1) irradiated by means of a beam of light ions having an energy of the order of or less than a hundred KeV and (2) the irradation dose is controlled so as to be a few 10^{16} ions/cm^2 or less, wherein the irradiation modifies the composition of 2 or 3 nearest atomic planes in the multi-layer material around an interface between two layers of the latter without overall mixing of the different layers of the multi-layer material.

As noted above, Steckl teaches using a beam of heavy ions (Si^{++} ions). Due to the use of these heavy ions, a mixed region is formed on the irradiated structure in Steckl. Consequently, in Steckl, the multilayer structure disappear, with irradiation, and forms a general mixed region.

Accordingly, Applicant respectfully submits that Claims 1 and 2 are not obvious over Steckl and requests that the rejection of Claims 1 and 2 under 35 U.S.C. § 103(a) be withdrawn.

VII. Claims 1-5 Rejected Under 35 U.S.C. § 103(a)

Claims 1-5 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Amaral. Applicant respectfully traverses this rejection.

Applicant respectfully submits that Steckl fails to teach or suggest a process in which a multi-layer material composed of thin layers is (1) irradiated by means of a

beam of light ions having an energy of the order of or less than a hundred KeV and (2) the irradiation dose is controlled so as to be a few 10^{16} ions/cm^2 or less, wherein the irradiation modifies the composition of 2 or 3 nearest atomic planes in the multi-layer material around an interface between two layers of the latter without overall mixing of the different layers of the multi-layer material.

As noted above, Amaral teaches using a beam of heavy ions that destroy and modify the chemical composition of different layers of the multi-layer material when it is irradiated. As a result, the irradiation process taught by Amaral causes formation of a mixed region and does not permit maintaining the multilayer structure.

Accordingly, Applicant respectfully submits that Claims 1-5 are not obvious over Amaral and requests that the rejection of Claims 1-5 under 35 U.S.C. § 103(a) be withdrawn.

CONCLUSION

In view of the foregoing, it is submitted that the claims are in condition for allowance. Reconsideration of the rejections and objections is requested. Allowance is earnestly solicited at the earliest possible date. If there are any fees due in connection with the filing of this response, please charge those fees to our Deposit Account No. 02-2666. If a telephone interview would expedite the prosecution of this Application, the Examiner is invited to contact the undersigned at (310) 207-3800.

Respectfully submitted,
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Dated: June 17, 2002

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CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that this paper is being facsimile transmitted to the Patent and Trademark Office, Box Non-Fee Amendments, Commissioner for Patents, Washington, D.C. 20231, on the date shown below.

Linda D'Elia June 17, 2002

Attachment: Version with markings to show changes made

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

Claim 1 has been amended as follows:

1. (Amended) Writing process on a multi-layer material composed of thin layers, in which said material is irradiated by means of a beam of light ions, having an energy of the order of or less than a hundred keV, wherein the material is a thin-layers material comprising buried layers deposited on a substrate, wherein one or more regions having individual sizes of the order of 1 micrometer or less are selectively irradiated, the irradiation dose being controlled so as to be a few 10^{16} ions/cm^2 or less, the irradiation modifying the composition of 2 or 3 nearest atomic planes in the material [at] around an interface between two layers of the latter without overall mixing of the different layers of the multi-layer material.